Researchers and technology: a phenomenological approach

Investigadores y tecnología: un enfoque fenomenológico

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ABSTRACT

This is a qualitative investigation that applied the phenomenological approach, with the intention of understanding the lived experiences of the researchers generated by the interaction with the technology towards their research ventures. The instrument used was an open questionnaire made by the researcher and whose content was validated before use. The data extracted from the narratives of the participants point to three main themes. These are the manifested characteristics of the researchers generated by the technology, the challenges faced during the development of the research generated by the technology and the values perceived in the production of the research generated by the technology towards personal and community development.

Keywords: technology-generated researchers, phenomenological approach.

RESUMEN

Esta es una investigación cualitativa que aplicó el enfoque fenomenológico, con la intención de comprender las experiencias vividas de los investigadores generados por la interacción con la tecnología hacia sus emprendimientos de investigación. El instrumento utilizado fue un cuestionario abierto hecho por el investigador y cuyo contenido fue validado antes de su utilización. Los datos extraídos de las narrativas de los participantes señalaron tres temas principales. Estas son las características manifestadas de los investigadores generados por la tecnología, los desafíos enfrentados durante el desarrollo de la investigación generada por la tecnología y los valores percibidos en la producción de las investigaciones generadas por la tecnología hacia el desarrollo personal y comunitario.

Palabras clave: investigadores generados por la tecnología, enfoque fenomenológico.

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I. Introduction

"The measure of greatness in a scientific idea is the extent to which it stimulates thought and opens up new lines of research. –Paul A.M. Dirac"

Numerous ideas, innovations, and inventions were made to improve the means of living. A man is never satisfied with what he has because of his brain complexities and lack of contentment. He never stops in believing that someday he will improve his life. Through his unlimited satisfaction, he continually aims in making discoveries, researches and inventions. He tends to improve what he believes in and uses in his daily living, which essentially involves technology. Technology, as defined in this study, is the process of determining the continuous application of science and research in making inventions or innovations in any field of industry. People who do research eventually encounter problems. These problems may bring forth trials and expectations, which may hinder the success in doing research.

In making technology generated research, some of the things that need to be considered are time, financial means, linkages, and untiring effort. Researchers in this field are not only known in piling books and securing data from primary and secondary sources, but also in inventing and innovating products and projects. They do experimentation and testing that may involve trial and error processes, and risk-taking advancements.

One of the primary concerns of the Commission on Higher Education is to promote strong research agenda that will solve the problems of the society. In higher education institutions, students and teachers are required to produce research. For the technological universities, it is a requirement to make technology as the epitome of their research scheme. Consequently, to achieve such notion, teachers and students should be made aware on how to do technology generated research. As stated by MacNamara (1985), the involvement of teachers is a great success as it intends to assist the success of technology in all educational fields. These teachers are the faculty researchers who assist their students in understanding the potentials of technology in the classroom which may lead them to work on inventions/innovations progress. Through the expertise of the teacher-researchers in the field of technology, students will eventually learn and be motivated in doing research. For these reasons, the researchers in this study aim to determine the challenges encountered by the technology generated researchers.

Researchers, both students and faculty, experience certain problems which lead them in the difficulty to finish their studies. Some of these problems, as mentioned by Physiovin (2009), (a.) lack of scientific training in the methodology of research, (b.) copying of data, (c.) manipulation of data, (d.) lack of availability or access literature needed, (e.) the outlook of the researcher, (f.) lack of confidence to take up a new study especially explorative study, (g.) making research as a formal requirement of the course and, (h.) expensive publishing and lack of availability of sponsors.

In addition to this, Bocar (2009), in her study, mentioned that the problems encountered by the researchers are both academic and personal in nature. Some of the problems categorized as academic were cooperation of the respondents, identification of researchable issue or construction of research title, while time and stress management are identified as personal problems. Bocar further added that financial problem, data analysis, conflict among research partners, limited time frame and lack of experience are problems which are a combination of both academic and personal.

Technology generated researches are more commonly known as design-based researches, where the researchers assume the three functions - as an inventor, a designer and a writer. The researchers in this field of study are expected to manifest scientific and humanistic attitude. Scientific attitude means the know - how process in dealing with scientific discovery and innovation, while humanistic attitude is the formation of values where the project concerned is focused on the welfare of the people. Wang and Hannafin (2006), said that design-based research is a combination of multiple design and research methods. The researchers seek to design and draw the procedure of the project and utilize both qualitative and quantitative methods in analysing data. It is a convergence of theory and practice. Design - based researchers play a vital role in technology. Wang and Hannafin also said that active involvement of the researchers in learning and teaching procedures is evidently needed in making experiments and exploration.

In some instances, researchers in this field are often confused of its importance. Dede (2004) cited that the skills of the creative designers and attributes of rigorous scholars overlap. He set an example wherein researcher-investigators seek more designs rather than that doing more of research. Moreover, Dede said that researchers have their weaknesses; they tend to produce designs which are likely to have an easy access for collection and analysis. This attitude leads them to "design constipation".

In making technology generated research, the researcher is demanded to produce a design which is far exemplar and generate evidence based on learning (Barab & Squire, 2004). Another feature of design-based research, as

mentioned by Barab and Squire, is a cognitively designed technology. Since technology is based on innovations, out of teaching and learning. However, a challenge met by the developers of this kind of research is to produce innovations which are sustainable, usable, and scalable. To meet its sustainability, the innovation should be created aligned with various components of the school system. In contrast, innovations force researchers to think out of the box. These innovations bring reforms and are aligned to address the insufficient demands of technology in the community. A key to successful reforms is a need for investment in professional development and logistical support to these innovations (as cited in Knapp:1997; Barab & Squire:2004). As to the usability of the innovation, three dimensions within the school system must be attended to. These are school culture, capability and policy/ management (Blumenfield:2000: Barab & Squire:2004).

This study seeks to further verify the challenges encountered by the teachers in making technology generated research. A few overarching questions serve as the guide in the pursuance of the study. These are:

(1) How can the interest, attitude and skills be described as technology-generated researchers?

(2) What are the challenges and experiences in conducting technology-generated research?

(3) What are the perceived values in conducting technology-generated research?

The findings of the study will significantly benefit the following groups: (1) The University Administrators will be more responsive in helping the researchers to overcome the difficulties in making technology- generated research. (2) The future researchers will be enlightened to enrich and enhance their understanding in producing technology generated research.

II. Method

Research Design

The research design of the study is a qualitative research. Wyse (2011) defined qualitative research as an exploratory research because it is used to gain understanding of reasons and provides insights into problem. It is used to uncover trends in thoughts and opinions. Under qualitative research it is classified as a phenomenological study. Phenomenological approach is used in this study because it is the most applicable method suitable for the investigation of phenomena of interest. According to Schuemann (2014), this approach depicts an understanding and discovery of data based on the actual experiences of the participants. In this study, the data gathered will be analyzed through phenomenological content analysis. This includes four intertwining steps - epoche, phenomenological reduction, imaginative variation and synthesis (Moustakas, 1994).

Sampling Technique and Participants

To obtain pertinent information, purposive sampling was used in choosing the participants of the study. The participants were chosen based on their capacity to do technology generated research. Criterion sampling was also used to focus on the population of researchers. The participants were classified based on the following criteria:

a. The participants of the study had produced completed two or more technology-generated researches.

b. The participants' area of specialization is related on the field of Science and Technology.

A total of eight (8) technology-generated researchers were the participants of the study.

Interview Instrument and Protocol

The instrument used in the study was an open-ended questionnaire which was content- validated by research experts. One of these research experts is a research instructor whose specialization is Science and Technology. Her degree as Doctor of Education specified her expertise in writing research. The other research expert has also a degree of Doctor of Education whose specialization is Home Technology. While the third research expert is an English and Research teacher. This expert also graduated and with a degree of Doctor of Education. The instrument was utilized so that the participants of the study can easily express their opinions. To supplement the data provided through the questionnaires, a follow-up interview was conducted. This was done to gain additional information and to obtain explanation on responses which needed further clarification.

Data Gathering

Data were personally gathered from the participants after permission was officially granted. All participants were provided the open-ended questionnaire. A follow-up interview was also conducted among the five participants.

The researchers decided to stop interviewing when a saturation point of responses was reached. This means that frequent similar responses were already provided and that no more new information was carried out (as cited in Galang,2014; Siegle,2002).

Data Analysis

Data gathered was transcribed and subjected for content analysis. To preserve confidentiality, participants identified were coded to TGR which means technology-generated researchers. The data were analyzed using the following steps, the epoche, phenomenological reduction, imaginative variation and synthesis. In the epoche, the researchers blocked biases and personal assumptions regarding to the existing phenomenon. In the second step, the phenomenological reduction, the researchers described the data with a context. This includes bracketing, categorizing themes. The next step, the imaginative variation, wherein the frames of reference and the perspectives diverged and by means of employing polarities and reversals. In this stage, intuition is purely imaginative and not empirical. Through imaginative variation the researcher can derive structural themes. The final step in the phenomenological research is the synthesis, where meanings and essences of the themes were connected to formulate a detailed diagram. (Moustakas,1994)

III. Findings and discussion

The purpose of this study was to explore the lived experiences of the faculty-researchers who had produce technology generated researches. The intention was to better understand how the lived experiences of the researchers would provide insights for other teachers who strive to produce technology-generated researches.

A qualitative approach to this study presented rich descriptions of the technology-inclined researchers' experiences to accurately describe the phenomenon. This phenomenon is basically the repeated challenges encountered by the technology-generated researchers. Each technology-based researcher has encountered these challenges. Data were collected through the use of open-ended questionnaire and in-depth interviews. The data were gathered by utilizing the proper protocols of the interview instruments. In the first step of data analysis, epoche was done by the researchers, setting aside from what is known. The next step is the phenomenological reduction, during this process, the researchers developed the themes and categorization of data. Then followed by the imaginative variation, to further understand the data and lastly the formation of synthesis.

Analyzing the data from these research questions yielded three interrelated themes presented on the findings. The overarching themes in this study revealed the lived experiences of the technology-generated researchers is based on their manifested characteristics which conform to their interest, attitude and skills, the personal and operational challenges and lastly the perceived values in the production of technology-generated researches towards personal and community development.

The major findings obtained from eight in-depth interviews beginning with a brief description of the interviewees. The eight participants were faculty-researchers who had produced technology generated researches. From these eight participants, two faculty members were selected from each of the following Colleges/Departments: College of Industrial Technology, College of Engineering and Architecture, College of Education, and Senior High School. All faculty members were recognized as technology-generated researchers in the University because they had produced and presented at least two (2) research projects. Thus, in this study, they were coded as TGR. The following are brief descriptions of each participant.

The first participant is TGR1 from the College of Industrial Technology. He produced technology research papers and prototypes in line with his specialization which is Automotive Technology. He holds a master's degree and attended various seminars, trainings and workshops related to his specialization and research theme conventions. Participant TGR2, on the other hand, is also a faculty researcher from the College of Industrial Technology. He produced technology-generated research papers, wherein two of which were presented in regional and national research competitions. His research papers are concentrated mostly on Electrical Technology. This faculty-researcher has attended various seminars related to his specialization and research. The faculty researcher who was coded TGR3 is from the College of Industrial Technology. He also presented technology-generated researches in the in-house review in the university. His area of specialization is Electronics Technology. This faculty-researcher also presented his research project in the regional research convention of the DOST. TGR4, from the College of Education, is a shop teacher who specializes in Home Technology. The focus of her research works is mostly on Food Technology and Garments Technology.

Another faculty researcher who is referred in this study as TGR5, is from the College of Engineering. His specialization is Electronics and Communication Engineering. His valuable research work was already patented and being utilized in one of the areas here in Pampanga. Another participant is TGR6, who is from the College of

Engineering. Her field of specialization is also Electronics and Communication Engineering. This faculty researcher presented her research works in United Kingdom and Japan. She produced numerous research papers wherein some of which were financed and utilized by some private corporations.

A faculty- researcher from the Senior High School Department whose code is TGR7, is a graduate of Doctor of Philosophy from Technological University of the Philippines. Her specialization includes Home Technology and professional education subjects. Aside from being a faculty member, she was also assigned as one of the directors in the university. Like the other participants, she also produced three technology-generated research papers. This faculty researcher was also recognized as best presenter in a research convention held outside the country. TGR8 is another faculty-researcher from the Senior High School. His specialization is Science. He produced a technology-generated research paper together with some colleagues from the Mexico Campus. He also presented some of his research papers in local, regional, and international conferences.

The data gathered from the interviews were content-analyzed and three major themes emerged that expanded and enriched the understanding of the lived experiences of these technology-generated faculty researchers. The first theme was manifested characteristics of technology researchers. The second theme was the challenges towards the development of technology generated researches and third theme was the perceived values in the production of technology generated researches towards personal and social development. It is noteworthy that the participants of the study shared their experiences in making technology-generated research. Based on their narratives, it was pointed out that to become a technology-generated researcher, the individual must develop certain characteristics which will eventually serve as the key in the pursuance and realization of research project. Niemec (2013), highlighted the fact that the character is a strength of an individual. As he explained,

> "These are revealed in universal personality traits through thinking or the method of cognition, feeling and willing or the affective domain and action or the actual behavior. He further gave emphasis that character strengths are the basic building blocks or the core parts of the personality that account for us being our best selves."

In this study, the participants identified these manifested characteristics, which conforms to the three factors-interest, attitude and skills that have greatly affected their actual experiences as techno-gen researchers.

A. Manifested Characteristics of Technology-Generated Researchers

In the first theme, these manifestations as defined in this context are the characteristics that the participants have which is related to their specific interest and attitude, and skills in making technology generated researches. These are the three factors that a technology-generated researcher must consider. Out of these three factors, three (3) subthemes emerged. These included the categories of constructive explorers (interest), positive outlook (attitude) and a technocrat (skills).

A.1 Constructive Explorers (Interest)

The interview questions that were utilized were designed to have a prompt dialogue with the technology-generated researchers towards their interest, attitude and skills. Majority of them said, it leads them to do research because they wanted to explore and experience. They believed that through exploration, they were challenge from their own curiosity to discover or develop a project or product. As they shared:

> "My interest lead me to produce a project because I want to explore raw materials that can be made into new products, finding strategies on how a product can be developed."(sic)- TGR5

> "it made more inquisitive about how products are developed"-TGR7

> "I discover new things… I have learned a lot"-TGR1

> "through research we were able to create or make something new"-TGR3

While another participant said it is not just exploration but also to experience what other researchers had accomplished and learned new ideas based on her specialization. This faculty-researcher proved that she was motivated and inspired by other researchers. As she said, she wants

> "to experience and explore what research enthusiast had done, and to continually update myself with new algorithms and approaches on engineering research."-TGR6

It was evident that these technology-generated researchers considered themselves as explorers of their own craft. Their interest to discover new things lead them to develop new products or projects and innovate themselves.

The first character strength based on the interest of the researchers is usually being described as the primary reason why a researcher does a research. For the participants, their interest is based on their curiosity, towards their area of specialization. This drives the participants to explore new ideas and challenged themselves on how can they develop, create or construct new projects or products. As Almy (2015), takes into his account that the best researchers are genuinely curious. Their curiosity is a product of being wide readers and observers. They were always looking forward or hunt for new insights and strategies which gives emphasis on how connected and inquisitive they are. This approach is known as an open-minded approach, they are amenable with innovation though they are grounded with objectives. This approach requires the researchers to explore and construct. Ritchie (1995) explained that a researcher is actively constructing his understanding to understand his own practice in exploring changes. During the constructive process, a range of concerns will arise. It is an approach where constructive and reconstructive elements will be identified. The technology-generated researchers intend to put their ideas of curiosity into reality. During the actual process of research, a technology-generated researcher will encounter problems or challenges. Having positive outlook is more likely one of the character strength that a researcher must possess as one of the major findings of the study.

A.2 Positive Outlook (Attitude)

The researchers also spoke of the importance of having right attitude in making technology-generated researches because it requires more positive outlook.

> "I am very optimistic that the product of the techno-gen researches cause improvements"-TGR3
>
> "I am determined to finish it"-TGR2
>
> "The right mindset that skills lead me to work independently…. consider all possibilities and filtering or adopting right attitude."-TGR6
>
> "you must be disciplined, there is the presence of eagerness and also be well motivated. in other words, determination and positivism must be possessed by a researcher because this will help you to achieve what you what to achieve." (sic)-TGR8

These technology-generated researchers are more resilient less likely to quit, in other words they are optimistic. As cited in an article entitled "Mindfulness and Positive Thinking" (2016), it was stated that individuals who are optimistic are more likely to engage in problem solving when they faced more difficulties. They tend to accept the difficult situation but more likely to think on the best possible solutions. It is worthy to emphasize that this character strength is indeed manifested to the participants. As they narrate their actual experiences in doing their research, they mentioned that they had faced difficult trials but eventually they come up with a solution which urged them to continue in doing their research project. Smith (2013) also pointed out that people having positive outlook in difficult circumstances can withstand or recover quickly from difficult adversities.

A.3 Technocrat (Skills)

All the researchers also claimed that having technical skill is advantageous because it helped them to understand technical terms and situations in developing their projects. It also paved the way to upgrade their capability know-how in their field of specialization.

> "I am more of a technocrat, I am skilled but I intend to learn more"-TGR2
>
> "I was able to used different software application… skills for me was developed through consistent practices and focus .."TGR6
>
> "...having technical skills kept my research easier and finished it in a short period of time"- TGR2
>
> " yes my technical skills helped me to develop a new product but in doing research it also helped me to level-up my skills to produce the target project."-TGR8
>
> "hindi ka pwede makagawa ng project kung wala ka technical skills..number one yun sa dapat meron kung gusto mo makagawa. Atsaka dapat naglelevel up ka sa bago technology ngayon. Dapat nag-aaral ka rin atsaka magseminar sa bago technology" (you cannot make a project without technical skills, it is the primary factor if you want to produce. You must upgrade yourself with the new technology. You must study and attend seminar about technology)- (sic)TGR1

However, it was also stressed in this study that everyone can become researchers but not everyone can produce a research project. A technology generated researcher is considered as a designer and inventor at the same time. He must be a technocrat, another manifested character. It was highlighted in this study that a technology-generated researcher must have the technical skills. A technocrat, as defined in the Harpers-Collins English Dictionary

(2017), as a scientist, engineer or expert who has technical knowledge. They are advocates of change in technology for the improvement of the community. They are experts of their own craft. Schoek (2007), described them as technical persons logical individuals who makes decisions or output based on scientific procedure and being correct and accurate is a precedent. Skills in this aspect are learned and studied. Producing technology-generated research projects is not as easy as it may sound. Even a technical person can create mistakes which may result to accidents or even death. It is important to note that a technology-generated research output had undergone a series of testing and experimentation and had been subjected by critical analysis of experts before it will be used in the community. Thus, a technology-generated research is made by highly technical skilled researchers or more commonly known in this study as technocrats.

The participants believed that their interest, attitude and skills have significantly influenced their pursuance to create or develop a new product. As they narrated:

> "my perseverance towards developing a product was enhanced..."-TGR5
>
> "it became a hobby for me and suits my interest for new learning…TGR7
>
> "challenge…basta me nabasa ako related sa automotive naging interesado ako yun na yun" (once I have read something which is related to automotive and I became interested then that's it)- TGR1
>
> "without..hmm.. the abovementioned interest attitude and skills, researches will not be accomplished." -TGR8
>
> "...attitude comes with interest My interest is for me to accomplish something through research and with the right attitude of accepting that I personally need help to study advance courses has contributed to the desired output of my research. Skills for me was developed through consistent practices and focus."-TGR6

It was evident from the responses that the researchers have manifested some characteristics based on their interest, attitude and skills. Their interest in their area of specialization drives them to curiosity on how to develop new products and how to level up their know-how skills. However, this curiosity cannot be put into realization if they do not have positive outlook to accomplish such task in doing techno-generated research. As one participant said that having right attitude is important in doing techno-generated research because trials will be encountered along the way. So as a technology-inclined researcher strong determination and patience are needed. Aside from having positive outlook, the technology-based researcher is also described as a technocrat, as the participants described themselves as technically skilled researchers. It was mentioned that they do not only do research but were also interested in upgrading their technical know-how. Anyone can do research but not everyone can produce technology-generated research without the technical skills.

Table 1 summarizes the participants' views on the Manifested Characteristics of Technology Generated Researchers which conforms to their Interest, Attitude and Skills. Participants' views on the manifested characteristics of technology generated researchers based on their interest, attitude and skills

Manifested Characteristics of Technology Generated Researchers	**Participant/s**
Category: Constructive Explorer (Interest)	
Sub code: Explore Raw Materials	TGR5
Sub code: Inquisitive on Development of Product	TGR7
Sub code: Discover new things	TGR1
Sub code: Create Something New	TGR 3
Sub code: Experience and Explore	TGR6
Total Number of Responses	**5**
Category: Positive Outlook (Attitude)	
Sub code: Optimistic	TGR3

Sub code: Determined to finish it	TGR2
Sub code: Right Attitude	TGR6
Sub code: Eagerness and Positivism	TGR8
Total Number of Responses	**4**
Category: Technocrat (Skills)	
Sub code: Technocrat and Skilled	TGR2
Sub code: Consistent Practice and Focus	TGR6
Sub code: Technical Skills	TGR8
Sub code: Naglelevel up ka sa bago technology (upgraded with the new technology)	TGR1
Total Number of Responses	**4**

B. Challenges Toward the Development of Technology-Generated Research

In doing research, a researcher will encounter problems along the actual process. The participants of the study said that there is a big difference in making technology-generated research from information dissemination papers. The effort is doubled because the researcher must invest both in the actual prototype as well in the manuscript. As it is given emphasis that producing technology-generated research is riskier. Though in producing any type of research, a researcher will face challenges. These adversities will either stop or let the researcher be more inquisitive to search for new solutions. Nevertheless, as what has been mentioned, a technology-generated researcher must manifest positive outlook to overcome the personal and operational challenges in producing a technical product or project. These problems were put into themes of personal and operational. In the context of the study, personal challenges mean that the problems arise because of the researchers own reason and control. While the operational challenges, as referred in this study as the problems met by the researchers during the actual operations of testing or process in the development of the research work. This research work is either the research project or the research manuscript.

The second theme emerging was the challenges met by the participants in making technology generated research.

When asked if they have encountered problems in making technology-generated research, most of the participants made a remark that there were a lot of them. They also said that making a technology-generated research in comparison to other types of research specifically information-dissemination papers, is riskier and takes a lot of patience. Some of them shared that

> "Mas mag-eeffort ka kasi dalawa yung ginagawa mo manuscript at prototype"-(sic)TGR8
>
> "You must really be ready in producing techno-gen research. It takes a lot of patience and determination".-TGR5
>
> "You are really going to take a risk, because what you are making is a project or a product which shall pass the actual testing. The problem is not on the paper, it is on the prototype"-TGR2
>
> "It is really an investment of effort and money, especially if you are experimenting or developing new product. There are times it does not taste good and will be easily spoiled. You have to do it again."-(sic) TGR4
>
> "Mahirap in a sense na alam mo kaya mo gawin pero pag andun ka na sa actual development ng project dun mo mararanasan na sasakit yung ulo ma sa kakaisip kung paano mo mapapaandar ng maayos."(it is difficult, but once you are in the actual development, that is the time that you will experienced headaches and confusion on how the project will function)-TGR1
>
> "Sometimes it happens, for you, you were able to produce a good project but once it will be evaluated by the panel during the in-house review… they will tell you to improve it more and it becomes more difficult on our part because you have to spend again though I understand it is for my own good"-TGR3
>
> "There was a slight deviation of expected output"-TGR6

The participants also identified the major challenges or problems met in the making their researches. These challenges were considered personal and operational. The problems on finances and time were categorized as personal while the problems on the actual development of the research project were categorized as operational challenges.

B.1 Personal Challenges Met in Conducting Technology Generated-Research

B.1.1 Lack of Budget

The most common problem in doing research is the lack of budget. Majority of the participants said that financial problem is their primary constraint. As they said:

> "It was costly… especially if the prototype has some malfunctions…. Trial and error costing…"-TGR3
>
> "Some of the materials needed are expensive…"-TGR6
>
> "It is not easy to produce a techno-gen research if you do not have the money to spend. There were some teachers who have good ideas but they cannot do it because of financial problem. There were some instances that you cannot complete the project because you do not have enough money"-TGR1
>
> "it is a risk to spend but it is worth it… pero talagang magastos" (it is expensive)- TGR3
>
> "the initial problem will always be money… you already have the initiative to do research but once you are in the project development and the needed materials are rare and expensive…"-(sic)TGR8
>
> "production of techno-gen research is easy as long as you have money"-TGR4

On the other hand, some participants also cleared out that this problem usually occur during the initial development of the project but once the project is completed and approved, the university or some agencies will help out in their financial needs.

> "it only happens on the first phase of the project development, but once the project is finished there are agencies or sometimes the university... who are willing to help to finance the project"-TGR8
>
> "there are some private companies who offered financial back-up for the improvement of the project"-TGR6

Among the personal challenges that was accentuated among the responses of the participants is the lack of budget or financial limitations. It is a common problem of the researchers, as Galang (2014) said the transportation, documentation, and testing the prototype were among the expenses that needs to be considered in making a research. The participants of the study even mentioned that without enough budget a researcher cannot proceed in the development of the actual project. In prototype or project development, budget is the first thing to be considered because a researcher needs to buy raw materials or sometimes tools. One of the participants said that there is a trial and error costing. A trial and error costing is an underlying principle of calculating the possible expenses during the testing process. There are incidents or emergency cashflows that a researcher must consider such as the malfunction of the prototype or the re-do method. The participants said that this problem usually occur in the initial development of the project. To push through in the research process, sometimes they have to wait for their salaries. But it was also mentioned, once the research project or prototype was approved there are agencies who eventually helped them to further improve their projects. One of these agencies that fully support technology-generated researches is the Department of Science and Technology. As cited in Galang, the agency provides funds to researches which focus on the sustainability of science and technology which can contribute to the national development. Furthermore, the National Research Council (2014) also noted that faculty working as an individual or a group must seek financial and logistic support outside the university.

B.1.2 Time

Another personal challenge encountered by the participants is on how to balance their time. Five participants said that time management is important in doing research. It really took them months to produce their research projects. Some even said that because of financial limitations, they were not able to finish their project on time. As they expressed their sentiments:

> "pag wala kang pera syempre stop ka muna sa paggawa hintayin mo muna meron dumating na pera para matuloy mo yung project kaya lumilipas yung panahon, dapat balance may pera at oras" (if you do not have money then you cannot do your research project, you have to wait, it must be balance you must have money and time.)-(sic) TGR3

> "there are two things that you have to consider in making techno-gen research, the manuscript and the paper… you have to balance your time"-TGR1

> "my primary responsibility as a teacher is to teach... then research… hindi madali to balance time… then you have other duties..."-TGR4

> "time constraints… minsan dami ng work… in doing the project it really needs focus and concentration"-TGR8

> "required much time to accomplish it"-TGR5

Aside from financial limitations, the technology-generated researchers also said that time was also among challenges they have encountered. Since they do thorough investigation and experimentation, sometimes a month is not enough for them to finish their project and the manuscript. As one said, time management is important in making a prototype. It cannot be rush, there is a need of precision and focus. However, on the part of some participants, it is quite difficult to balance their time because they have other duties aside from teaching. Though it is a problem, the participants also knew that the only solution to solve this problem is to manage their time.

B.2 Operational Challenges Met in Conducting Technology-Generated Research

The participants also experience these operational challenges. These problems were encountered during the actual process of doing the research project.

B.2.1 Lack of Facilities for Research

One of the operational challenges that was mentioned by the participants was the lack of facilities and equipment which are needed in the actual testing of the project. The researchers said that they need to use some appropriate facilities which can fully support the actual testing of their projects. Based on the testimonies of the participants

> "we do not have the actual laboratories to test the projects… iba yung laboratory sa shop… iba yung testing laboratory na kailangan… kaya lang syempre hindi walang choice kung hindi sa bahay or sa shop na lang gawin yung test. Sa actual testing kasi kailangan ng tamang equipment…" (the shop laboratories is different from the testing laboratory…so there is no choice but to do the testing at home or in the shop. In the actual testing there is a need for equipment…)- TGR2

> "on my case mahirap kasi wala tayo testing center… sana bago ipatest sa DOST maundergo muna sya sa atin kaso we do not have the research laboratory for technology." (on my case it was difficult because we do not have a testing center.. I hope before it will undergo a test at DOST, it will be tested here but the we do not have research laboratory for technology)-TGR8

One of the major challenges met by the participants in doing this type of research is the actual development of the research project. In the actual operations, the testing of the project is important. Hence, majority of the participants said that lack of appropriate equipment and research laboratory is a problem. Accurate testing can only be done with the use of right equipment. The participants said that it will be much easier if a research laboratory for technology exist within the university. The research laboratory is a facility where testing of prototypes or projects and where danger might happen. The National Research Council (2014), stated that a research laboratory is needed to ensure the safety of the researchers shall be built within the government agencies especially on state public universities. The facility to be built shall ensure the safety of the faculty and students. As suggested that the research laboratory must include

"awareness of the physical and chemical properties of the laboratory reagents and the safety and health hazards they pose, availability and used of proper apparatus and control infrastructure to carry out proper procedures, knowledge and application of any additional special practices necessary to reduce risks, extinguishers and eye stations, well-designed and organized workspace that facilitates operation, use of proper personal protective equipment."

-National Research Council (2014), p.47

Having research laboratory within the university may help the researchers to save time and money. Another operational problem that was mentioned in the study is the unavailability of the needed material. It was pointed out that just one screw missing can slow down the whole research process. In making a research project, preparation and canvassing of materials is an initial step. However, there are some uncontrolled circumstances that cannot be foreseen by the researcher.

B.2.2 Unavailability or Rarity of Materials for Research Project

Aside from the lack of the testing center, two participants also shared their experience about the unavailability or rarity of materials needed for their project. One openly shared:

> "minsan walang available na material… kung meron man mahal kasi mahirap hanapin…turnilyo na nga lang.. isa na lang kailangan tapos wala pa supply kaya minsan napapatagal yung paggawa." (there are times, there are no available materials… or if there available it will be expensive because it is very rare… sometimes you only need one screw, but because there is no supply the project cannot be finished on time)- TGR1

Another participant also said that

"In doing techno-gen project, a trial and error or experimentation is a must, so sometimes there are materials that you really need to solve the problem. In the first phase, you will prepare and check the availability of the materials… so assuming you already have them but as you go along the actual process you will just find out that there is still a missing material needed and sometimes there are no available material."-TGR2

In the actual development and testing of the project, sufficient facilities, equipment and materials were needed. However, problems arose when the needed facilities, equipment and materials were unavailable. Even though they experienced these difficulties during the actual process of the project development, the participants still managed to find solutions to solve their problem. One commented that

"kung wala iadjust mo yung project para matest sa kung ano yung available equipment o testing kit." (you have to adjust/change the project which can be test to available equipment or testing kit.) -TGR1

Another participant said that

"I am a researcher I have to find out how will I solve my problem its either I will look for another material that is available or less expensive which I can use for my project."-TGR2

This proves their positivity on their part in accomplishing their research project. To solve these issues, the technology-generated researchers, since they manifest a character strength of having a positive outlook. They can find ways on how to adapt such situations. As the participants said they will either adjust their project or look for other parts or materials that can be used to substitute the missing part. In testing project, its either they will look for someplace where they can do the actual testing or adjust the project so it can be tested with the available equipment. Though, lack of materials in research may trigger patience and weakness of the researcher. This was proven by in the study of Pitesa and Thau (2014), wherein they said that lack of materials and resources may render vulnerability in coping up with the situation.

B.2.3 Writing the Research Manuscript

However, there were other participants whose problems arose during the writing of the manuscript. One participant said

"It was really hard especially there is no exact format provided by the university for techno-gen papers… they will tell its APA format, but it is a techno-gen research"-TGR1

While another participant commented

"I am a technical expert but when it comes to writing the manuscript I am having a hard time… sometimes I can finish the project on time but not the manuscript..."-TGR2

Nevertheless, these participants were asked on how they managed to overcome such problem.He said

"I asked the help of some colleagues to help me with the format… but the format provided has some inconsistencies."-TGR1

While the other participant said that

"With the help of my wife who is also interested in research, helped me in writing the manuscript, the problems encountered in research are easily coped with"-TGR2

While the researchers are making their actual project, they also wrote their manuscripts, which is also considered as one of the hindrances in producing a technology-generated research. There were participants who said, it is because of the research format provided by the university, while others admitted that they are more focus in developing the project than in writing the manuscript. This was resolve by the participants by asking some help from their colleagues who are experts in writing the manuscript.

In doing research, there are risks and problems that may arise. It just proves that once the researcher overcome such challenges, he will eventually accomplish his work. With the narratives of the participants, it only points out that they surpass these challenges. As one said, it is not easy do to a technology-generated research. Exertion of effort, spending money and time are among the factors to be considered. Based on the narrations of the participants, resourcefulness, and ability to adapt a situation is needed. These participants prove the statement "if there is a will, there is a way".

Table 2 summarizes the participants' experiences on the challenges they had encountered in doing their research projects and manuscripts.

Table 2. Challenges met by the technology-generated researchers

Challenges Towards the Development of Technology-Generated Research	**Participant/s**
Category: Personal Challenges	
Code: Lack of Budget	
Sub code: Trial and Error Costing	TGR3
Sub code: Expensive materials	TGR6
Sub code: Money	TGR1 TGR8 TGR4
Sub code: Talagang magastos (really expensive)	TGR3
Total Number of Responses	**6**
Code: Time Management	
Sub code: Lumilipas yung panahon (time passed by)	TGR3
Sub code: Balance your time	TGR4 TGR5 TGR1
Sub code: Time Constraints	TGR8
Total Number of Responses	**5**
Category: Operational Challenges	
Code: Lack of Facilities and Equipment for Actual Testing	
Sub code: Actual testing laboratories	TGR2

Sub code: Research Laboratory	TGR8
Total Number of Responses	**2**
Code: Unavailability of Raw Materials	
Sub code: Expensive and Rare Materials	TGR1
Sub code: No available materials	TGR2
Total Number of Responses	**2**

C. Perceived Values in the Production of Technology-Generated Researches towards Personal and Community Development

This theme emerged based on the views of the participants on how they value the technology-generated researches. All participants answered that in doing this type of research it helped them to realize that research is not just a paper but a realization to put it into concrete idea and product which contributed to their personal growth and community welfare.

C.1 Community Welfare

Majority of the responses of the participants, when they were asked what made them to produce a research project, is to improve the means of living of the people. This response is an evident reason why researchers do research. As the participants said

> "It is man's way of solving his little and big problems in life. Through research, life is made easy because of the discovered solutions to his day to day problems."-TGR5

> "In the area of improving the lifestyles or uplift the living condition of less fortunate community."- TGR4

Furthermore, a participant also said that:

> "It made me realize that research is valuable in improving one's life"-TGR7

> "In the community life is made easy through vendos (mineral water vendo) and accessibility of the gadgets and inventions in the community."-TGR2

> "The technology generated research of an individual, private sector or school is a social responsibility to improve lifestyle, source of living, improve energy and solutions to other problems facing the country."-TGR6

C.1.1 School Community

On the hand, there were some participants who also pointed out the value of research in the University. They said that as teachers they are expected to produce research because they can help the University to achieve its vision. Three participants stated that:

> "It is important to conduct techno-gen research in school because they can be patented and used in SUC levelling."-TGR8

> "Very important for a technological university like us. We are expected to innovate and achieve the research function of the university. The university is expected to achieve the vision of the Ched."-TGR5

> "technology-generated research must be the output of an institution with technology courses. This reflects the acquired knowledge of the students and serves as one of the gauge of the school in offering the course."-TGR6

> Furthermore, the participants also said that in making technology-generated research it helped them to improve their methods of teaching. As one participant described

> "In the school, it's a big help. It has facilitated quality or optimum teaching and learning in the shop through the trainer kit. I developed one trainer kit which is a big help on the hands-on performance of my students."-TGR2

> In the university, students were also encouraged to do their own research which is technologically based. One participant said that

> "we involve the students so they will be able to solve their problems within the community and school. I am reminding them that writing their thesis is not just a requirement but for them to solve the needs and learned from experience as what I have learned"- TGR8

Generally, participants were concerned about the needs of the community and their concern for the school. They do research not only for themselves but they wanted to help and address the needs of the people. Moreover, it was evidently shown in their narratives that they are teachers who shared their contributions to the students, improve their means of teaching and teach their students to take part in doing research.

C.2 Personal Growth

The participants further added that producing technology-generated research helped them to discovered more of themselves. They give emphasis that it helped them to grow professionally not only on their field but also in other specialization. All of them openly shared

> "It made me appreciate the importance of technology-generated/ experimental researcher… I can say that I am now one of them. I produced a project that helped the community"-TGR5

> "It has helped me grow professionally. It has opened opportunities for me to venture on the other fields aside from electrical technology."-TGR2

> "It boosted my confidence in the field of teaching"-TGR8

> "It helped to be updated on the different processes in developing products technology-generated research refreshed me on different aspects of my specialization. It made me more inquisitive about how products are developed."TGR7

> "Since I am an Engineering graduate it help me more I studying for my further studies especially in master's degree. As well as in teaching my students as they are also gaining additional knowledge from me."-TGR5

> "The exposure to different software applications and electronic hardware technology had lead me to broaden my avenues or possible researches in electronics, energy and communication"-TGR6

Writing a research paper is already a challenge, but it is much more challenging if the researcher can produce an actual project. It is in this view that the researchers of the study asked the participants what made them to do technology-generated research. Most of them said it is for their professional growth and they wanted to help the school and the community. It in this essence that these findings were considered as the visions and mission of the technology-generated researchers. They are envisioning that they can help the community, schools, students and even themselves. They believed that it is their mission and role as teachers to become researchers. Through their research outputs, they have created noble projects which somehow brought changes in the community, in the school, to their students and to their professional enhancement. Teachers, who are engage in research are empowered to become more self-directed in seeking improvement in their teaching practice (Tan,2014). Moreover, as cited in Lim and Kim (2015), a teacher is an artist and technician, which identifies that it is inherent that he is a reflective practitioner. Thus, it is further concluded that the technology-generated researchers are visionaries and missionaries of change.

Table 3 Shows the summary of the Responses on the Perceived Values in the Production of Technology-Generated Researches towards Personal and Community Development. Perceived values in the production of technology-generated researches towards personal and community development.

Perceived Values in the Production of Technology-Generated Researches towards Personal and Community Development	**Participant/s**
Category: Community Development	
Code: Help the people in the Community	
Sub code: Man's way of solving his little and big problems	TGR5
Sub code: Improving the lifestyles or uplift the conditions of the less fortunate in the community	TGR4
Sub code: Improving one's life	TGR7
Sub code: Community life is made easy	TGR2
Sub code: Solutions to other problems facing the country	TGR6
Total Number of Responses	5
Category: School Community	
Code: Research Function of the University	
Sub code: Used in SUC levelling	TGR8
Sub code: Innovate and research function of the university	TGR5
Sub code: output of an institution with technology courses	TGR6
Sub code: facilitated quality or optimum teaching and learning	TGR2
Sub code: Involve the students so they will be able to solve their problems within the community and school	TGR8
Total Number of Responses	**5**
Category: Personal Development	
Code: Personal Growth	
Sub code: Experimental Researcher... I can say that I am one of them	TGR5
Sub code: Helped me grow professionally	TGR2
Sub code: Boosted my self- confidence in the field of teaching	TGR8
Sub code: Helped me to be updated on the different processes	TGR7
Sub code: Gaining additional knowledge	TGR5
Sub code: broaden my avenues or possible researches	TGR6
Total Number of Responses	**6**

After all the painstakingly efforts in producing research projects or products, actual process has influenced the personal and professional growth of the faculty-researchers. First, it boosted their confidence to accomplish a useful project. It gave them sense of pride because finally after all the investments, risks and criticisms, they could produce a notable output. Second, it helped them to be exposed on the new trends in technology. Doing research helped them to upgrade their skills and broaden their knowledge. Third, faculty researchers had sense of fulfillment because they accomplished their research projects and some of which were now used in the community.

Synthesis of Interpretation

The Venn diagram depicted the lived experiences of a sample of eight technology generated-researchers. Overall, the discussion revealed that participants have their vision to improve the quality of life in the community and for professional advancement. They achieved their vision because they possessed the manifested characteristics of a technology-generated researcher. These characteristics conforms to their interest, attitude and skills. In this context, they were considered as constructive explorers because they produced project out of their own curiosity. They managed

to overcome the challenges because they have the right attitude and lastly, they are technically skilled individuals, who brought changes for innovation and progress.

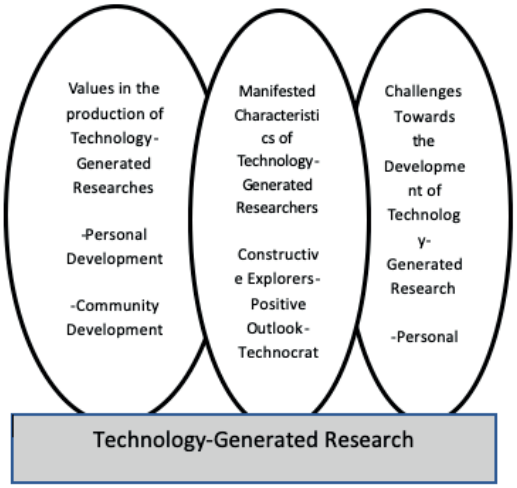

Figure 1. Techonology generates research

Summary, conclusion and recommendation

The study presented a portrait of the experiences of the technology-generated researchers. Their stories developed a foundation of knowledge on how these researchers value the technology-generated research despite of the challenges they encountered. It is from the rich descriptions evolving from the techno-gen researchers' stories that the researchers of the study based the recommendations for practice. The researchers believed that this study would have relative implication for the faculty, and administrators. The technology-generated researchers expressed their voices through their lived experiences, was always present as the researchers explored and defined the phenomenon.

Based on the findings, technology-generated researchers have manifested characteristics which benefitted them to produce a research project. Their intentions of curiosity, towards their specialization encourage them to discover and explore new things. They push themselves to their limits because they believed they can do it as long they have the right and positive outlook whatever challenges that they may encounter. Since they are inclined with technology, it is expected that they are experts in this field. From this point of view, teachers whose specialization is inclined with technology, shall push themselves to be geared with the rapid technological changes in the society. It is important to note that they shall get out from their comfort zones. They need to motivate and challenge themselves that they need to grow. It is already a fact that teachers are reflexive on work planning and knowledge sharing on the community needs or mutual interest. It is the role of the teachers to be involved and produced greater efforts in developing new projects which can bring new services and development in the community. Doing technological-generated researches can also bridge the gap between the school and community. The schools are considered as the frontiers of changes on the current trends of technology. These technological changes sufficiently uplift the standards of living.

On the other hand, it is not easy as it may seem to produce a research project. It takes enormous time and investment of effort and money to be engaged in technology-generated research. For this matter, it is further recommended that the administration shall help its faculty members to overcome the hindrances that they may encounter during the actual development of the project. Teachers and administrators are considered partners in producing quality research outputs. Thus, it is the role of the administrators to equipped its teachers with knowledge, guidance and support.

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